REMARKS

Claims 1-14, and 18-37 are pending in the application. Claim 20 has been amended. New claim 37 has been added. No new matter has been added. Reconsideration of the claims, in view of the comments provided below, is respectfully requested.

Applicants respectfully point out that claims 12-14 are indicated as being rejected in the Office Action Summary, but that the Detailed Action does not indicate that claims 12-14 are rejected, and contains no discussion of claims 12-14. Nevertheless, Applicants submit the following response to further prosecution of this application. Should there be a further Office Action following the this response, Applicants request that it not be a Final Action, since there has been no opportunity to discuss claims 12-14.

Rejection under 35 U.S.C. § 103(a)

Claims 1-11, 18 and 19

Claims 1-11, 18 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,459,487) (Chen). Chen has been described in a previous paper.

It is stated in the Office Action that Chen teaches all the elements of claim 1 except that Chen does not expressly say that the first and second polarized beams have a polarization direction that is orthogonal to each other [sic]. It is further stated in the Office Action that it would have been obvious to one of ordinary skill in the art to use beams with orthogonal polarization.

Claim 1 is directed to a birefringent interferometer that includes, *inter alia*, a first birefringent element that splits an input light beam into first and second beams of orthogonal polarizers, and a second birefringent element that combines the beams of orthogonal polarizations. The first birefringent element is oriented to receive the polarized input light beam along a z-direction, a y-direction is defined perpendicular to the z-direction and at 45° to the polarization direction of the polarized input light, and an x-direction is defined orthogonal to both the y-direction and the z-direction. The first birefringent element has an optical axis lying at a selected angle, θ, relative to the z-direction in the y-z plane defined by the y-direction and the z-direction. The second birefringent element has an optical axis lying at the negative of the selected angle, -θ, relative to the z-direction in the y-z plane defined by the y-direction and the z-direction.

Chen does not teach or suggest that the first birefringent element has its optical axis lying at +θ relative to the z-axis and the second birefringent element has its optical axis lying at –θ relative to the z-axis. The present Specification (page 8, line 20 – page 10, line 9) describes how the birefringent crystal splits a light beam into ordinary and extraordinary rays, where the extraordinary ray walks-off from the ordinary ray at an angle, α. The walk-off direction of the extraordinary ray in the birefringent crystals is a result of tilting the optical axes of the crystals along the z-axis. Thus, for example in the embodiment illustrated in FIG. 4, in the first birefringent crystal 406a, the ray 470 walks-off from the ray 472 in a first direction that has a +ve y component and a –ve x-component, according to the coordinate convention of that figure. The ray 470, on passing into the second crystal 406b, propagates in a direction having a –ve y-component and a +ve-x-component. Thus, the ray 472 propagates within the second birefringent crystal that is different from the direction within the first birefringent crystal. This is a result of the optical axis of the first and second crystals being at +θ and –θ respectively.

Chen fails to each this. Instead, examination of Chen's system in FIG. 1 shows that the walk-off direction in the first crystal 34, i.e. the propagation direction for the beam deviated by the crystal, is parallel to the walk-off direction in the second crystal 40. This means that the two crystals 34 and 40 in Chen's system have their optical axes at the same angle, θ, to the z-axis. Accordingly, Chen fails to teach that the two crystals have their optical axes set at +θ and –θ, respectively, to the z-axis.

Applicants, therefore, respectfully disagree with the Examiner's assertion that the only element of claim 1 not taught by Chen is that the beams have orthogonal polarization. Chen also fails to teach or suggest that the first and second birefringent elements have their optical axes at +θ and –θ relative to the z-axis respectfully. Acccordingly, claim 1 is not obvious in view of Chen, and is patentable thereover.

Claims 2-11, 18 and 19 depend from allowable claim 1, and further define the invention of claim 1. Therefore, these claims are also allowable.

<u>Claims 20-24, 27, 35 and 36</u>

Claims 20-24, 27, 35 and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Bareket et al. (U.S. Patent No. 4,480,916) (Bareket) in view of Murayama et al. (U.S. Patent No. 4,165,937) (Murayama). It is stated in the Office Action that Bareket teaches a polarization

beam splitting means (16), a polarization beam combining means (22), a polarization sensitive detection means (24, 28) and a wavelength selection means (34). It is also stated in the Office Action that Murayama teaches that a Rochon prism functions as a birefringent element and that one of ordinary skill in the art would recognize that the Bareket's recomb prism (22) functions as a birefringent element.

Three criteria must be met to establish a *prima facie* case of obviousness. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference, or combination of references, must teach or suggest all the claim limitations. MPEP § 2142. Applicants respectfully traverse the rejection since the proposed combination of references fails to teach or suggest all the elements of the claims.

Independent claim 20 is directed to an interferometer that comprises birefringent polarization beam splitting means for splitting an incoming polarized light beam into first and second light beams of orthogonal polarization and birefringent polarization beam combining means for combining the first and second light beams of orthogonal polarization into an output beam. The polarization states of the first and second light beams are maintained between the polarization beam splitting means and the polarization combining means. Polarization sensitive detection means is provided for detecting polarization of the output beam and wavelength selection means is used for selecting a wavelength of light detected by the polarization sensitive detection means.

Independent claim 22 is directed to a polarization interferometer that comprises a birefringent beam splitter having an input path and first and second output paths and a birefringent beam combiner having first and second input paths and an output path. The first and second input paths of the birefringent beam combiner are aligned respectively with the first and second output paths of the birefringent beam splitter. Polarization states of light propagating along the first and second output paths from the birefringent beamsplitter to the birefringent beam combiner remaining unchanged between the birefringent beamsplitter and the birefringent beam combiner. A polarization sensitive detector is disposed on the output path of the birefringent beam combiner.

Bareket fails to teach or suggest all the elements of claims 20 and 22. In particular, Bareket fails to teach or suggest wavelength selection means for selecting a wavelength of light detected by the polarization detection means. It is stated in the office action that Bareket's spectrum analyzer (34) is a wavelength selection means. Applicants respectfully disagree. Bareket's interferometer system produces an interference fringe pattern that is detected by two photodiodes (30, 32) spaced 20 mm apart (col. 2, line 64-col. 3, line 4). The photodiodes are scanned using a motorized detection assembly (28) to scan the interference plane. The electrical signals thus produced by the photodiodes are fed to the spectrum analyzer and to an oscilloscope. Thus, the spectrum analyzer is used for analyzing electrical signals, not to select the wavelength of the light detected by the photodiodes. Furthermore, the light source is a polarized helium neon laser, which is well known not to be a tunable light source, but a source of a single wavelength of light, and so no wavelength selection is necessary in Bareket's system.

Applicants also disagree with the statement that Bareket's recombination prism (22) functions as a birefringent element. Bareket's recombination prism is shown in FIG. 3 and described at col. 2, lines 53-58: the "two beams 19 and 20 are recombined by means of a prism assembly 22. As shown in FIG. 3, prism assembly 22 first inverts the parallel beam, using a dove prism A, then superimposes them at a beamsplitter B. The inversion is important in order to avoid shearing by wavefront reversal". Thus, Bareket's recombination prism comprises two elements, namely a dove prism, and a polarization beamsplitter, neither of which is taught as being birefringent. A polarization beamsplitter is conventionally a stack of dielectric layers formed on one hypotenuse of a first prism which is then attached to the hypotenuse of a second prism (see page 2 of the attached printout entitled "Beamsplitters and Polarizer", and published by Optical Components Inc. at http://www.ocioptics.com/beamsplit.html). Such a polarizer, invented by MacNeille, US Patent No. 2,403,731), passes the light beam at Brewster's angle within the dielectric stack, so that one polarization state is transmitted with no reflection and the orthogonal polarization state is reflected by the stack. This type of polarizing beamsplitter contains no birefringent material. Moreover, Bareket specifically teaches away from using a birefringent combiner, such as a second Rochon prism, stating that the wavefront inversion produced by the recombination prism is important as it avoids the introduction of wavefront shearing.

Accordingly, Bareket fails to teach or suggest the use of birefringent polarization beam combining means and a birefringent beam combiner, and thus fails to teach all the elements of claims 20 and 22. Likewise, Murayama fails to teach using a birefringent beam combiner or birefringent polarization beam combining means. These claims, therefore, are not obvious in view of the proposed combination of references and are patentable thereover.

Claims 21, 23, 24, 37, 35 and 36 depend from, and further define the inventions of, claims 20 and 22. Since claims 20 and 22 are allowable, claims 21, 23, 24, 37, 35 and 36 are also allowable.

Claims 25 and 26

Claims 25 and 26 are rejected as being unpatentable over Bareket and Murayama in view of Chen. It is stated that Chen teaches the use of a tunable light source, and that it would have been obvious to use a tunable light source in order to maintain the desired frequency of the light source so that the measurements are performed accurately with a known frequency in the even of frequency drift. Applicants respectfully disagree with the motivation to combine Chen with Baretek and Murayama suggested in the Office Action. If frequency drift were considered to be a problem, then surely a frequency stabilized laser would be the preferred solution, rather than a tunable laser, which is more difficult to keep at a constant frequency. Moreover, Baretek teaches the use of a helium neon laser, whose output is based on an electronic transition in neon atoms, whose frequency is known to be relatively stable. Therefore, one of ordinary skill would not be motivated to use a tunable source for the proposed reason.

In addition, Chen fails to remedy the deficiencies of Baretek discussed above.

Therefore, since claims 25 and 26 depend from allowable claim 22, claims 25 and 26 are also allowable.

Claims 28-34

Dependent claims 28-34 are rejected as being unpatentable over the proposed combination of Baretek, Murayama and Brooks (U.S. Patent No. 5,675,411). Brooks has been described previously.

Brooks fails to rectify the deficiencies of Baretek and Murayama discussed above with respect to claim 22, and so claims 28-34 are also allowable.

New claim 37

New claim 37 has been added and depends from independent claim 22. Support for new claim 37 is provided in FIG. 5 and its description in the specification. No new matter has been added.

Conclusion

In view of the amendments and reasons provided above, it is believed that all pending claims are in condition for allowance. Applicant respectfully requests favorable reconsideration and early allowance of all pending claims.

If a telephone conference would be helpful in resolving any issues concerning this communication, please contact Applicant's attorney of record, Iain A. McIntyre at (612) 436-9610.

Respectfully submitted,

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